Darby Lumber Lands Detailed Sediment Assessment and WEPP Model Results

May 4, 2018

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Background sediment estimates were provided by the Bitterroot Headwaters TMDL (2006) and the Bitterroot Temperature and Tributary Sediment Total Maximum Daily Loads and Framework Water Quality Improvement Plan (2011). These documents estimated background sediment for impaired streams and included the East Fork (including Robbins Gulch), and the Rye Creek watershed. Both of these areas discussed in the TMDL's are very large compared to the activity area and the potential sediment contributions in Darby Lumber Lands II. In the East Fork, background sediment from roads was estimated at 1570 tons/year from native surface roads (DEQ, 2006) while in the Bitterroot Temperature and Tributary Sediment TMDL (DEQ, 2011) native surface roads in Rye Creek were modeled to produce 64 tons/year. Lands within the project area that are not included in either TMDL analysis are similar geology, similar parent material and similar land use to the East Fork and Rye Creek and background sediment levels would be similar.

To estimate sediment contributed by stream crossings in the TMDL planning areas, a subset of unpaved mountain landscape stream crossings were visited on the ground by the planning team and sediment delivery estimated based upon measured contributing area. These calculations estimated 0.12 tons/year of sediment contributed at each crossing or about 240 pounds/crossing/year. Mean sediment loads were also calculated for unpaved parallel road segments and was estimated at 2.21 tons/year/mile. These figures will be used as an existing condition for crossings in the Darby Lumber Lands 2 project as much of the project area was evaluated in this TMDL document and soils and vegetation conditions are similar to those in the watersheds actually measured during TMDL analysis.

The WEPP Model (Elliot et al, 2000) was used to estimate sediment contributions to streams from proposed activities in the Darby Lumber Lands Phase II project (DLL2). Existing condition estimates were completed, followed by changed conditions resulting from harvest, prescribed fire, travel level and road improvements (BMP's or Best Management Practices).

WEPP uses a climate model to determine storms and resulting erosion for modeled sites. Two custom climates were created and used based upon the Stevensville weather station but customized for elevation, latitude and longitude in the DLL project area. One custom climate was used for the higher elevation harvest and another for estimating erosion from lower elevation road treatments.

Latitude and longitude and elevation were determined from google earth, and output values used to adjust the climate for the project area.

Area of Project	Latitude	Longitude	Elevation
Harvest	46.1013	-114.1150	5335'
NFSR 321	46.0212	-114.0159	4935'

<u>Sediment Contributions from Log Haul in North Rye, NFSR 321</u>

Forest Road (FR) 321, the North Fork Rye road, parallels the stream for about six miles. This road receives considerable private residential traffic though the lower private land portion and is graveled.

The gravel surface continues beyond the forest boundary to approximately the junction with NFSR 1127 where the road is native surface for the remainder of its length. Because this route was not identified as a potential haul route until after the end of field season, no on-the-ground measurements or identification of specific sediment producing areas were identified. Instead, for analysis purposes the entire section of road is presumed to be in need of upgrades to reduce sediment and will be modeled as such for existing condition and then modeled in an improved condition to test effectiveness of proposed upgrades. Model results are not absolutes and although not specific to any one site on the North Fork Rye road, modeling results show how upgrades would affect sediment contributions. The model results are suitable for comparison of alternative actions and relative level of improvements.

Table 1, below displays a summary of the WEPP output for the North Rye Road. In this table the existing condition is delivery of sediment in pounds/year is displayed in the first column; the second column displays sediment delivery during the log haul time period; and the third column the sediment delivery after the haul is completed and the final grading and maintenance of the road has occurred to ensure the BMP's are functioning. The results are similar to those model estimates completed for the Gold Butterfly Project (PF-AQUATICS-013), another Forest project that proposes hauling on a streamside road and application of BMP's to protect water quality. The model results suggest that as a result of BMP application, sediment delivery from NFSR 321 would be similar to the existing condition during the log haul, and reduced from the existing condition when the log haul is over and the final grading/maintenance has been completed.

Table 1, North Rye Haul Route Sediment Estimates

Existing Condition, reported in pounds/year	Contributions During Log Haul with BMP's applied, reported in pounds/year	End Result After Log Haul, BMP's applied and Functional, reported in pounds/year	BMP's included in model scenario
36.5	36.7	22.6	Gravel on insloped road
25.6	24.9	15.1	Vegetated ditch on insloped road and gravel
34.6	37.2	22.2	Outsloped road with gravel, some rutting
59.7	0	0	Outsloped road with gravel and no ruts

In the DLL2 project, the WEPP model suggests that the application of BMP's would essentially maintain sediment delivery during the log haul period at levels similar to the existing condition. At the end of the haul, when traffic reverts to normal levels, there would be reduction of sediment delivery from NFSR 321 and contribute to improved channel conditions in North Rye Creek in the long-term.

Table 2 is the WEPP:Road Output for North Rye Modeling Efforts

The Green highlight represents the existing condition, with residential and recreational traffic, yellow represents the proposed action condition, BMP's applied and haul traffic and Aqua highlights are the end condition of the road, low traffic levels with BMP's applied and functional.
Those lines not highlighted represent conditions on the road that should be avoided during the DLL2 project (not maintained, no BMP upgrades).

Table 2, WEPP:Road Output Estimates for North Rye

DLL 2 North Fork Rye Rd
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Surface, traffic	Design	Road grad	Road len	Road width	Fill grad	Fill len	Buff grad	Buff len	Precip	Rain runoff	Snow runoff	Sed road	Sed profile	Comment
native low	insloped bare	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.06 in	0.46 in	50.21 lb	36.52 lb	Native, low
native high	insloped bare	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.06 in	0.46 in	149.20 lb	62.71 lb	Native,high
graveled low	insloped bare	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.05 in	0.21 in	27.26 lb	22.63 lb	Gravel, low
graveled high	insloped bare	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.05 in	0.21 in	71.73 lb	36.78 lb	Gravel, high
native low	insloped vegetated	4 %	500 ft	14 ft	50 %	10 ft	25 %	20 ft	21.47 in	0.06 in	0.46 in	20.08 lb	25.60 lb	Native, low, vegetated ditch
native high	insloped vegetated	4 %	500 ft	14 ft	50 %	10 ft	25 %	20 ft	21.47 in	0.06 in	0.46 in	54.52 lb	49.92 lb	Native, high, vegetated ditch
graveled high	insloped vegetated	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.05 in	0.21 in	31.56 lb	24.98 lb	Gravel, high, vegetated
graveled low	insloped vegetated	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.05 in	0.21 in	14.35 lb	15.16 lb	Gravel, low, vegetated
native low	outsloped rutted	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.06 in	0.46 in	41.60 lb	34.59 lb	Outslope, rutted, low
native high	outsloped rutted	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.06 in	0.46 in	124.81 lb	59.70 lb	Outslope, high, rutted
graveled low	outsloped rutted	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.05 in	0.21 in	24.39 lb	22.23 lb	Outsloped, rutted, low, gravel

Surface, traffic	Design	Road grad	Road len	Road width	Fill grad	Fill len	Buff grad	Buff len	Precip	Rain runoff	Snow runoff	Sed road	Sed profile	Comment
graveled high	outsloped rutted	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.05 in	0.21 in	63.12 lb	37.19 lb	Outsloped, rutted, graveled, high
native low	outsloped unrutted	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.00 in	0.00 in	28.70 lb	0.00 lb	Outslope, unrut, native, low
native high	outsloped rutted	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.06 in	0.46 in	124.81 lb	59.70 lb	Outsloped, native, rutted, high
graveled low	outsloped unrutted	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.00 in	0.00 in	25.83 lb	0.00 lb	Outslope, unrutted, gravel, low
graveled high	outsloped unrutted	4 %	500 ft	14 ft	50 %	10 ft	10 %	20 ft	21.47 in	0.00 in	0.00 in	55.96 lb	0.00 lb	Outslope, unrutter, graveled, high

Sediment Contributions on Main Rye between Highway 93 and the Junction with NFSR 321

On April 12, 2018 conditions on the main Rye Road between Highway 93 and the junction with NFSR 321 were field reviewed and found that the main Rye road is a low gradient road located in a low gradient valley. Roadside berms and low gradient vegetated buffers between the road and the stream limit opportunities for sediment to travel from the road to the stream. WEPP:Road was used to model potential sediment contributions at the site at MP (mile post) 2.7 where the road was closest to the stream. The model estimated that between 0.2 and 1.1 pounds of sediment per year could be contributed to the stream depending upon the condition of the road (maintenance or lack of it) during high traffic conditions. This is a relatively small amount compared to the sediment contributed from upstream forest roads. Assuming that the maximum level of sediment contributions were to occur at the 5 sites where sediment contributions were field verified as likely, approximately 5.5 pounds of sediment/year could be contributed from the Rye Creek Road during log haul. This amount would not be measurable or observable in the stream. Based upon model estimates and field verification, the risk of sediment contributions from hauling on the main Rye Road between the junction with NFSR 321 and Highway 93 is low (PF-AQUATIC-016).

Disturbed WEPP Output for Harvest:

WEPP was also used to estimate sediment contributions from harvest and prescribed burn units located in the northern part of the analysis area. This data along with the conclusions in Project File document AQUATICS-007 and AQUATICS-010 (a summary description of WEPP model efforts for past harvest and prescribed fire projects) was used to draw conclusions on sediment contributions to area streams from harvest activities.

Monitoring efforts on the Bitterroot National Forest (Forest Plan Monitoring Reports 2008-2015; Project File Document AQUATICS-003) have found that riparian buffers (RHCA buffers) provide an effective buffer between treatment units and streams that protect water quality. The vegetation treatments proposed in DLL 2 are located adjacent to or upstream of non-fish bearing intermittent streams. The RHCA buffers in DLL 2 are narrower than those applied around fish-bearing streams, and range from 100 feet around Roan Gulch and Harlan Creek (intermittent streams), to 50 feet around many unnamed tributaries. Several proposed units were modeled that were considered “high risk”-because of steep slopes. The WEPP model results suggest that even with the 50-100 foot RHCA buffers, there was no delivery of sediment from either cable/skyline yarding on steeper slopes or tractor yarding. These results are supported by other modeling efforts on earlier projects (PF-AQUATICS-010), and by several years of monitoring by Forest fisheries biologists who found no instances of sediment leaving units, entering RHCA buffers, or penetrating through the RHCA buffers to enter streams (Forest Plan Monitoring Reports, 2008-2015; PF-AQUATICS-003).

A subset of the DLL 2 units were modeled for “worst case scenario” for prescribed fire with high severity fire in the uplands and high severity fire in the RHCA buffers, which is an unlikely event (PF-AQUATICS-007). The model suggested about a 6% probability that sediment would be contributed to streams in the event of high severity fire. Monitoring of numerous prescribed fire units by Forest fisheries biologists indicates that due to the low intensity of prescribed fire, it rarely burns in RHCA buffers with any significant intensity, and sediment contributions to streams from prescribed fire either do not occur, or are incidental and negligible (Forest Plan Monitoring Reports, 2008-2015).

Road Decommission/Storage

Evaluation of sediment contributions from road decommissioning or storage where soil disturbance is within sediment contributing distance of streams (< 300 feet) occurred. Review of literature and monitoring associated with culvert removal indicates that when BMP's are applied, approximately 4 pounds of sediment is contributed when the culverts are removed (Foltz et al., 2008). Most of this sediment is deposited within the first 600 feet of the construction site (see authors cited in USDI Fish and Wildlife Service, 2012, 2015), and occurs within the first 24 hours following culvert removal. Sediment traps, diversion of flows, revegetation, mulching and slashing of exposed fill slopes are mitigations that would be applied at culvert removal sites to minimize sediment delivery.

Except for NFSRs 466 and 62647 in the Robbins Gulch drainage, NFSR 311 along a tributary to Rye Creek, and NFSR 62430 on a tributary to North Rye Creek, the roads proposed for decommissioning or storage in DLL 2 are mid-slope roads and near streams only at stream crossings. The Table 3 below lists the number of culverts proposed to be removed by watershed, and the estimated sediment contributions from those culvert removals (Foltz et al., 2008). Monitoring of decommissioned and stored roads indicates that vegetation recovers on the decompacted surfaces within about 3 years (USDA Forest Service, 2017). Because the soils have been decompacted, precipitation tends to infiltrate rather than runoff the treated surfaces downhill towards streams.

Table 3, Sediment Estimates from Stream Crossing Removal

Watershed Name	Number of Crossings Removed from Streams	Estimated Sediment Contributions in the Short-term*	Long-term Sediment Reductions in pounds/year from Culvert Removal**
Little Sleeping Child	9	36 pounds	2160 pounds
Lower Fork Rye	8	32 pounds	1920 pounds
Upper Rye Creek	7	28 pounds	1680 pounds
Bitterroot River-Laird (Robbins Gulch)	6	24 pounds	1440 pounds
Bitterroot River-Darby (Burke Gulch)	10	40 pounds	2400 pounds
Bitterroot River-Lick Creek (Harlan Creek)	0	No Change	No Change

*Following culvert removal

**Based upon TMDL field measurements

Robbins Gulch is an intermittent tributary to the East Fork Bitterroot River. The East Fork is listed as water quality limited and a sediment TMDL has been developed that recommends reduction of sediment from forest roads by 42% in this hydrologic unit. Two roads in the Robbins Gulch drainage (NFSRs 446 and 62647) have segments located in the floodplain of Robbins Gulch that deliver sediment directly to the stream, and restrict channel migration- in some locations the road fill is the stream bank. About 2.2 miles of those near-stream road segments (NFSR 446 1.5 miles + NFSR 62647 0.7 miles) would be decommissioned with the DLL2 project, these segments currently contribute sediment to the Robbins Gulch stream channel year long. An upland road (Connector E) about one mile long would be

constructed in order to provide vehicle access from Robbins Gulch to the Moonshine divide. Recontouring of NFSRs 446 and 62647 would result in disturbed soils and potential for erosion and sediment delivery to Robbins Gulch in the short term (about three years) but would eliminate most of NFSR 446 and 62647 sediment delivery in the long-term. BMP's in the form of mulching, slashing, seeding and fertilizing would limit sediment delivery while vegetation was recovering.

WEPP:Road was used to model the existing condition sediment contributions for near-stream roads such as in FR 446 in Robbins Gulch and estimated 123 pounds of sediment delivered annually for each 1000 foot length of road. The length of road in Robbins Gulch along the stream is actually about 8,753 feet or 1.7 miles and sediment delivery is estimated at 1,077 pounds of sediment/year. To estimate contributions after decommissioning, WEPP:Road was used and the input variables were changed to narrow the road, reduce the length of fill, and slightly widen the vegetated buffer between the road and the stream. The model predicted that no sediment would be contributed after recontouring. As the decommissioned road is no longer a road (is decompacted and restored to a hillslope, several Disturbed WEPP runs were made to determine sediment contributions from a forest floor with poor grass cover (after recontour, mulching and slashing) and then with good grass cover (to represent condition after three years); both scenarios estimated no sediment contributions. Although no sediment contributions were estimated by the model, it is reasonable to assume that some erosion and subsequent sediment contributions could occur from a newly recontoured road that is located within a few feet of a stream. Using the logic that a culvert removal contributes about 4 pounds of sediment, the project hydrologist estimated that each 200 foot segment of NFSRs 446 and 62647 (see the discussion above for Road Decommission/Storage) could contribute up to about 4 pounds of sediment to Robbins Gulch, for a total contribution of up to 175 pounds of sediment/year for the length of disturbance from road recontour. This would decline as vegetation becomes established on the recontoured surfaces, and within 3-5 years no sediment would be delivered to Robbins Gulch. Monitoring of past restoration work at stream crossings indicates that vegetation does recover and soils are adequately vegetated within three years (PF-AQUATICS-025 and Forest Plan Monitoring Reports 2008-2015 https://www.fs.usda.gov/detail/bitterroot/landmanagement/planning/?cid=fseprd490792).

NFSR 311 closely parallels an unnamed tributary to Rye Creek for about 1.6 miles and is proposed for decommissioning. This action was identified in Travel Planning but would be implemented with this project. Similar to our methods for Robbins Gulch above, we assumed that in the existing condition 1039 pounds of sediment are contributed annually and that after implementation every 200 foot length of recontoured road could contribute up to about 4 pounds of sediment to the unnamed tributary, for a total contribution of up to 169 pounds of sediment the first year after implementation. This would decrease as vegetation became established.

NFSR 62430 closely parallels an unnamed tributary to North Rye Creek for about 0.7 miles and is proposed for decommissioning. Using the same method for calculating sediment from existing roads as Robbins Gulch, this road could contribute about 454 pounds per year in its current condition. After recontour, and assuming that every 200 foot length of recontoured road could contribute up to about 4 pounds of sediment to the unnamed tributary, a total of up to 74 pounds of sediment/year could be contributed until the recontoured surfaces become adequately vegetated.

Compared to sediment contributions from open roads that are located in the stream floodplain, the short-term contributions from decommissioning and the removal of erosive roads that deliver sediment

year-long is considered a benefit to watershed conditions as removal of these streamside roads not only would reduce sediment contributions but would also allow the stream to establish a natural meander pattern, and develop functional wetlands along the valley bottom. The improvements would contribute to the reductions recommended in the Bitterroot Headwaters TMDL (MDEQ, 2005) and Bitterroot Temperature and Tributary Sediment TMDL (MDEQ, 2011).

Table 4, WEPP Estimate of Sediment Contributions from Decommission of Streamside Roads

Road Numbers and Drainage Name	Estimate of Existing Sediment Contributions Road within 100' of Stream	After Decommission, Year 0 (depending upon vegetation recovery and erosion)	Following Vegetation Recovery (3-5 years)
NFSR 446 and 62647, Robbins Gulch. Total of 1.7 Miles	1,077 pounds/year	0-175 pounds/year	Natural erosion and sedimentation levels -0 pounds/year
NFSR 311, unnamed tributary to Rye Creek, 1.6 miles	1,039 pounds/year	0-169 pounds/year	Natural erosion and sedimentation levels -0 pounds/year
NFSR 62430, unnamed tributary to North Rye Creek, 0.7 miles	454 pounds/year	0-74 pounds/year	Natural erosion and sedimentation levels -0 pounds/year

Road Construction

About five miles of specified road construction and about seven miles of temporary road construction (5.9 miles of temporary road + 1.1 miles of tracked line machine trails) is proposed in DLL 2. The majority of this construction would occur in the Harlan Creek watershed (Bitterroot River-Lick Creek HUC) to facilitate removal of timber from the project area. The majority of these roads are located more than 300 feet from streams, and at distances more than 300 feet from streams, road construction is not expected to contribute sediment to streams.

Limited road construction would occur within sediment contributing distance of streams. The only place where specified road or temporary road construction would enter an RHCA buffer (100 feet width) would be along the lower 0.4 miles of Roan Gulch, an intermittent tributary to Harlan Creek. Activities in this hydrologic unit do not have a connection to the Bitterroot River and effects would be limited to Harlan Creek. Other temporary roads and tracked line machine trails would not enter RHCA buffers. BMP's would be applied to the new road segment in Roan Gulch. These BMPs would include applying slash, mulch, seeding and fertilizing on cut and fill slopes to reduce sediment contributions and facilitate vegetation recovery, and installing dips and outsloping of the travelway to maintain proper drainage. WEPP Modeling of sediment contributions for this road suggest that the proposed design (outsloped) combined with BMP's, and a vegetated stream buffer would result in sediment contributions from 0 to less than 80 pounds per year depending upon the exact slope of the buffer (PF-AQUATICS-009). On private land, an existing low standard but stable road would need spot gravel surfacing to allow for log truck traffic. The new road would be water barred and closed to public use following harvest activities.

Summary of effects by Hydrologic Unit -maybe not say what as did that earlier and only summarize qualitiatively?

Hydrologic units where prescribed fire and timber harvest include Little Sleeping Child, Bitterroot River-Darby and Bitterroot River-Laird and Bitterroot River-Lick Creek. These activities would occur at varying levels and BMP's would be applied as would INFISH buffers. Model results suggest that due to use of RHCA buffers, sediment delivery from these types of activity is unlikely. Monitoring by forest fisheries biologists' support that conclusion.

Little Sleeping Child Creek-0704. Proposed activities in Little Sleeping Child Creek that could affect sediment delivery include:

- Road construction (temporary, specified and TLM trails)
- Culvert removals from decommissioned and stored roads
- Decommission of Trail 164
- Timber harvest and prescribed fire
- Construction of Connector A and B

The proposed road construction is located above perennial or intermittent streams and would not cross into or enter RHCA's and is not expected to contribute sediment due to the distance from streams. Nine culverts would be removed and analysis indicates about 36 pounds of sediment could be contributed during and immediately following culvert removal but in the long term sediment delivery would be reduced, channels would recover allowing for long-term sediment reduction, connectivity above and below the culvert location would be reestablished, there would be wetland improvement at the site of culvert removal and elimination of future culvert failure risk.

Trail decommission is near Sleeping Child Creek and would likely involve spreading rocks and/or other debris over the tread to allow natural recovery to continue. Limited ground disturbance is expected and should it occur disturbed areas would be seeded, fertilized and mulched. There is very low risk of decrease of stream channel conditions to Little Sleeping Child Creek from this proposed activity and there would be localized improvements in channel conditions.

Construction of the connectors would result in two fords on the upper reaches of tributaries to Little Sleeping Child Creek. The fords would be hardened to protect the channel to the extent possible. It is expected that at the ford the channel condition would change but channel conditions above and below the ford would not be measurable. These sites would be monitored and adapted if needed to protect water quality.

Lower Rye Creek-0802. Proposed activities in Lower Rye Creek that could affect sediment include:

- Culvert removals from decommissioned and stored roads
- Decommission of NFSR 62430
- Log haul on County Road 9101
- Log Haul on FR 321

Eight culverts would be removed and analysis indicates about 32 pounds of sediment could be contributed during and immediately following culvert removal. In the long term sediment contributions would be reduced and channels would recover allowing for long-term sediment reduction, reestablished connectivity, wetland improvement at the site of culvert removal and elimination of culvert failure risk.

Decommission of 0.7 miles of streamside road could potentially contribute sediment to an unnamed tributary to North Rye during and immediately following implementation. In the long-term when vegetation is established, sediment delivery to this stream would be decreased by about 450 pounds/year and lead to improved stream conditions.

County Road 9101 traverses a relatively wide valley with a gentle gradient, as a result the road is also relatively flat. These gentle gradients, combined with vegetated buffers results in low risk that sediment from NFSR 75/County Road 9101, the main Rye Creek Road between U.S. Highway 93 and NFSR 321, could enter Rye Creek during log haul periods. Restricting the log haul to the summer/autumn period (no hauling after November 1) and the gentle gradient and un-rutted surface of this road make the sediment delivery risk from hauling fairly low. Modeling, based upon field inventory suggests that there are a few limited sites for sediment to travel to the stream and the vegetation would filter most sediment before it reaches the stream. The model estimate about 5.5 pounds of sediment/year could be contributed during log haul from sites close to the stream without vegetative buffers. If sediment delivery were to occur, it would likely be of immeasurable amounts.

The main activity of concern in Lower Rye Creek is log hauling on NFSR 321, where it parallels the North Fork Rye. Because of this, BMP upgrades are proposed and the WEPP model predicts that with the application of BMPs, sediment contributions from NFSR 321 would be similar to the existing condition during the log haul, and reduced from the existing condition when the log haul is over and the final grading/maintenance has been completed. The BMPs would meet the intent of the TMDL and lead to better conditions in the long term.

Upper Rye Creek-0801. Proposed Activities in Rye Creek include:

- Decommission of NFSR 311 as identified in Travel Plan
- Culvert Removal from decommission and storage of roads

In Upper Rye, seven culverts would be removed to store and decommission roads. Model estimates 28 pounds of sediment could be contributed during and immediately following removal. In the long term, these sites would have functional stream channels, wetlands.

The main activity of concern related to sediment in Rye Creek is the obliteration of 1.6 miles of NFSR 311 that closely parallels an unnamed tributary to Rye Creek. The WEPP model suggests that there would be no sediment contributions from this proposed activity, however monitoring has shown that there can be sediment contributed the first few years at culvert removal sites and since this road was constructed on the stream channel and disturbed soils would follow road obliteration (similar to a culvert removal), there would be soils along the bank that could erode given the right conditions (high flood waters, high intensity storms). BMP's would be applied that could include straw bales, silt fences to trap sediment as well as mulching, slashing, seeding, fertilizing on the recontoured slopes. These sediment controls (BMP's) would limit contributions until vegetation became established. The long-term benefits of road removal outweigh the short-term risk of sediment contributions and would contribute to improved channel conditions in the unnamed tributary and downstream in Rye Creek. Road improvements would meet the intent of the TMDL to reduce sediment contributions from forest roads, and lead to better channel conditions in the long term.

Bitterroot River-Laird-0506-Proposed Activities in Robbins Gulch include:

- Specified Road construction-Connector E
- Culvert removals from decommissioned and stored roads
- Decommission of streamside roads 446 and 62647

Robbins Gulch is within the much larger East Fork Bitterroot River-Laird hydrologic unit, with activities proposed only in Robbins Gulch with DLL 2. The proposed new road construction is located above perennial or intermittent streams and is planned to replace the portion of NFSR 446 that would be decommissioned to improve Robbins Gulch stream channel conditions. This road would not cross into or enter RHCA's and is not expected to contribute sediment due to the distance from streams.

Six culverts would be removed and analysis indicates about 24 pounds of sediment could be contributed during and immediately following culvert removal but in the long term sediment contributions would be reduced and channels would recover allowing for long-term sediment reduction, connectivity reestablished, wetland improvement at the site of culvert removal and elimination of culvert failure risk would occur as a result of proposed activities.

The greatest risk of sediment contributions is from the obliteration of 2.2 miles of road that was constructed within a few feet of the stream (FR 466 and 62647). The WEPP model suggests that there would be no sediment contributions from this proposed activity, however monitoring has shown that there can be sediment contributed the first few years at culvert removal sites and since this road was constructed on the stream channel and after recontouring there will be bare soil very near the stream in some locations (similar to a culvert removal) that could erode given the right conditions (high flood waters, high intensity storms prior to vegetation being established and stabilized soils) some sediment delivery is expected. BMP's would be applied that could include straw bales to trap sediment as well as mulching, slashing, seeding, fertilizing on the recontoured slopes. These sediment controls (BMP's) would limit contributions until vegetation became established. The long-term benefits of road removal outweigh the short-term risk of sediment contributions and would contribute to improved channel conditions in Robbins Gulch. The road improvements would meet the intent of the TMDL and lead to better conditions in Robbins Gulch in the long term. Over time, this could translate into improved channel conditions in Robbins Gulch and slightly cleaner substrate conditions in the East Fork Bitterroot River near the mouth of Robbins Gulch.

Bitterroot River-Darby-0806 Proposed Activities in Burke Gulch include:

- Culvert removals from decommissioned and stored roads

The portion of the DLL 2 project in Burke Gulch is extremely small compared to the much larger Bitterroot River-Darby HUC that extends from the confluence of Rock Creek upstream to Chaffin Creek and included lands on both sides of the Bitterroot River (Over 30000 acres). Ten culverts would be removed and analysis indicates about 40 pounds of sediment could be contributed during and immediately following culvert removal but in the long term sediment contributions would be reduced and channels would recover allowing for long-term sediment reduction, reestablish connectivity, wetland improvement at the site of culvert removal and elimination of culvert failure risk.

Bitterroot River-Lick Creek-0807 Proposed Activities in Harlan Creek include:

- Road Construction (Specified and temporary road)
- Timber harvest and prescribed fire

The portion of the DLL 2 project in HUC 0807 is small compared to the much larger Bitterroot River-Lick Creek HUC that extends from the confluence of Rock Creek downstream to the confluence with Skalkaho Creek and includes lands on both sides of the Bitterroot River (34048 acres). The greatest risk of sediment contributions is from the road construction, and log haul on roads adjacent to Roan Gulch, a tributary to Harlan Creek. WEPP model results suggest that no sediment would be contributed from 0.4 mile road construction and use of the stream bottom road due to distance from the stream (20-100 feet), a vegetated buffer in place, use of BMP's during construction and log haul, and road design.

Approximately 0.9 mile of temporary road would be constructed near several mapped streams in McKinney and Harlan Gulches. Field verification by the project fisheries biologist found no stream at the location of proposed road construction. Temporary roads would be recontoured seeded and fertilized following use. Neither Harlan Creek, Roan Gulch nor McKinney Gulch are connected to the Bitterroot River. McKinney Gulch is intercepted by the Big Ditch and downstream of the ditch is intermittent wetland; Harlan Creek flows into the ditch along the Old Darby Road and eventually ends up in a wetland not connected with the river. Proposed activities are unlikely to deliver sediment to the river.

Background Sediment Comparison

Sediment produced from the Darby Lumber Lands II project is estimated to be small (measured in pounds) in comparison to the background levels (measured in tons), and sediment reductions from the activities proposed in the long term would contribute to improved conditions and meet the TMDL direction. Changes in sediment contributions from the proposed actions are not likely to be measurable in either Rye Creek or the Bitterroot River but would improve channel conditions in the vicinity of the treatment area and tributary streams where the improvements were implemented.

References:

PF-AQUATICS-025 Watershed Improvement white paper

PF-AQUATICS-010 Gold Butterfly Summary of WEPP Modeling Results

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